

AMENDMENTS TO THE CLAIMS

The following is a complete, marked up listing of revised claims with a status identifier in parentheses, underlined text indicating insertions, and strikethrough and/or double-bracketed text indicating deletions.

LISTING OF THE CLAIMS

1. (Currently Amended) A liquid crystal display device, comprising:
 - a plurality of scanning lines;
 - a plurality of signal lines provided so as to cross the scanning lines;
 - a liquid crystal layer having liquid crystal molecules, each of which has a substantially fixed twist angle in a direction perpendicular to substrates sandwiching the liquid crystal layer, the liquid crystal layer having a characteristic that a viewing-angle-derived difference of luminance of pixels occurs between target pixels, which are at different positions and receive a same driving voltage, by a difference of their viewing angles on viewing from one viewing point~~depending on an observation direction, compared with right opposite viewing,~~ due to asymmetry of alignment direction of the liquid crystal molecules;
 - pixel capacitors, respectively formed on pixels corresponding to intersections of the scanning lines and the signal lines, which include pixel electrodes and common electrodes, and correspond to the liquid crystal layer; and
 - a common electrode voltage supplying circuit for supplying common electrode voltages to the common electrodes, said common electrode voltage supplying circuit being capable of adjusting the common electrode voltages and changing magnitudes of the common electrode voltages depending on a position of the pixels in the liquid crystal panel so that such driving voltages as to decrease the viewing-angle-derived difference of luminance of pixels are generated.

2. (Previously Presented) The liquid crystal display device as set forth in claim 1, wherein:

the common electrodes of the pixels are divided into a plurality of groups, and
the common electrode voltage supplying circuit is capable of respectively adjusting the common electrode voltages so that the common electrode voltages are adjusted independently for each group.

3. (Original) The liquid crystal display device as set forth in claim 1, wherein:

at least first pixel capacitors and second pixel capacitors are provided on each of the pixels as the pixel capacitors, and

the common electrode voltage supplying circuit is capable of respectively independently adjusting a common electrode voltage supplied to common electrodes corresponding to the first pixel capacitors and common electrode voltages supplied to common electrodes corresponding to the second pixel capacitors.

4. (Previously Presented) The liquid crystal display device as set forth in claim 3, wherein:

the common electrodes corresponding to the second pixel capacitors are divided into a plurality of groups, and

the common electrode voltage supplying circuit supplies the common electrode voltage at a same value to the common electrodes corresponding to the first pixel capacitors, and is capable of respectively adjusting the common electrode voltages supplied to the common electrodes corresponding to the second pixel capacitors independently every groups.

5. (Original) The liquid crystal display device as set forth in claim 4, wherein:

the common electrodes corresponding to the first pixel capacitors are divided into a plurality of groups, and the common electrode corresponding to the second pixel capacitors are divided into a plurality of groups, and

the common electrode voltage supplying circuit is capable of respectively adjusting the common electrode voltage supplied to the common electrodes corresponding to the first pixel capacitor independently every groups and is capable of respectively adjusting the common electrode voltages supplied to the common electrodes corresponding to the second pixel capacitors independently ever groups.

6. (Original) The liquid crystal display device as set forth in claim 2, wherein the common electrodes are grouped for n lines of the scanning lines (n includes one), where n is a positive integer.

7. (Original) The liquid crystal display device as set forth in claim 4, wherein the common electrodes are grouped for n lines of the scanning lines (n includes one), where n is a positive integer.

8. (Previously Presented) The liquid crystal display device as set forth in claim 6, wherein:

the common electrode voltage supplying circuit supplies a common electrode voltage which functions as a reference common electrode voltage to a group corresponding to a scanning line positioned on a first side of the liquid crystal display device in a direction in which the scanning signals are disposed, and

the common electrode voltage supplying circuit supplies a common electrode voltage which has a value different from a value of the reference common electrode voltage to a group corresponding to a scanning line positioned on a second side of the

liquid crystal display device in the direction in which the scanning signals are disposed.

9. (Original) The liquid crystal display device as set forth in claim 7, wherein:

the common electrode voltage supplying circuit supplies a common electrode voltage which functions as a reference common electrode voltage to a group corresponding to a scanning line positioned on the one side in a direction in which the scanning signals are disposed, and

the common electrode voltage supplying circuit supplies a common electrode voltage which has a value different from a value of the reference common electrode voltage to a group corresponding to a scanning line positioned on the other side in the direction in which the scanning signals are disposed.

10. (Original) The liquid crystal display device as set forth in claim 6, wherein:

the common electrode voltage supplying circuit supplies a common electrode voltage which functions as a reference common electrode voltage to a first group corresponding to a scanning line centered in a direction in which the scanning lines are disposed, and

the common electrode voltage supplying circuit supplies a common electrode voltages which is higher than the reference common electrode voltage to a second group corresponding to a scanning line positioned on the one side in the direction in which the scanning lines are disposed, and

the common electrode voltage supplying circuit supplies a common electrode voltage which is lower than the reference common electrode voltage to a third group corresponding to a scanning line positioned on the other side in the direction in which the scanning lines are disposed.

11. (Original) The liquid crystal display device as set forth in claim 7, wherein:

the common electrode voltage supplying circuit supplies a common electrode voltage which functions as a reference common electrode voltage to a first group corresponding to a scanning line centered in a direction in which the scanning lines are disposed, and

the common electrode voltage supplying circuit supplies a common electrode voltages which is higher than the reference common electrode voltage to a second group corresponding to a scanning line positioned on the one side in the direction in which the scanning lines are disposed, and

the common electrode voltage supplying circuit supplies a common electrode voltage which is lower than the reference common electrode voltage to a third group corresponding to a scanning line positioned on the other side in the direction in which the scanning lines are disposed.

12. (Original) The liquid crystal display device as set forth in claim 1, comprising a signal line driving circuit for supplying a display signal voltage to each of the signal lines, wherein

the common electrode voltage supplying circuit is provided in the signal line driving circuit.

13. (Original) The liquid crystal display device as set forth in claim 6, wherein the common electrode voltage supplying circuit adjusts the common electrode voltages supplied to the groups so that luminance of the pixels gradually varies so as to be monotonously darker or so as to be monotonously brighter from one end side to a center of the scanning lines in a direction in which the scanning lines are disposed.

14. (Original) The liquid crystal display device as set forth in claim 7, wherein the common electrode voltage supplying circuit adjusts the common electrode voltages supplied to the groups so that luminance of the pixels gradually varies so as to be monotonously darker or so as to be monotonously brighter from one end side to a center of the scanning lines in a direction in which the scanning lines are disposed.

15. (Canceled)

16. (Previously Presented) The liquid crystal display device as set forth in claim 2, wherein the common electrode voltage supplying circuit adjusts the common electrode voltages so that luminance and color variation of the pixels are corrected so that a visual angle with respect to a liquid crystal panel, viewed from an arbitrary position in front of the liquid crystal display device, is wider than a visual angle in a case where the common electrode voltages of all the groups are equal to each other.

17. (Original) The liquid crystal display device as set forth in claim 16, wherein the common electrode voltage supplying circuit adjusts the common electrode voltages so that luminance and color variation of the pixels are corrected so that a visual angle with respect to a liquid crystal panel, seen from an arbitrary position in an up-and-down direction, is wider than a visual angle in a case where the common electrode voltages of all the groups are equal to each other.

18. (Original) The liquid crystal display device as set forth in claim 4, wherein the common electrode voltage supplying circuit adjusts the common electrode voltages so that luminance and color variation of the pixels are corrected so that a visual angle

with respect to a liquid crystal panel, seen from an arbitrary position, is wider than a visual angle in a case where the common electrode voltages of all the groups are equal to each other.

19. (Original) The liquid crystal display device as set forth in claim 18, wherein the common electrode voltage supplying circuit adjusts the common electrode voltages so that luminance and color variation of the pixels are corrected so that a visual angle with respect to a liquid crystal panel, seen from an arbitrary position in an up-and-down direction, is wider than a visual angle in a case where the common electrode voltages of all the groups are equal to each other.

20. (Original) The liquid crystal display device as set forth in claim 1, wherein the common voltage supplying circuit includes:

- an input terminal for receiving a voltage which functions as a standard voltage of the common electrode voltages;
- a resistance element whose one end is connected to the input terminal;
- a constant current source for causing a constant current to flow to the resistance element;
- an output terminal, connected to other end of the resistance element, which outputs an output voltage; and
- a data latch circuit for outputting adjustment data, in accordance with which (i) a current value of the constant current caused to flow by the constant current source and (ii) a direction in which the constant current caused to flow are switched, to the constant current source.

21. (Previously Presented) The liquid crystal display device as set forth in claim 1, comprising:

a signal line driving circuit for supplying a display signal voltage to each of the signal lines; and

a reference voltage generating circuit for generating reference voltages, having plural levels different from each other, which are supplied to the signal line driving circuit so as to make gradation display in accordance with a display signal, said reference voltage generating circuit being capable of adjusting the reference voltages.

22. (Original) The liquid crystal display device as set forth in claim 21, wherein the reference voltage generating circuit adjusts the reference voltages so that a predetermined gamma characteristic is obtained in an arbitrary line of lines each of which is constituted of the pixels provided in a direction in which the scanning lines are disposed.

23. (Original) The liquid crystal display device as set forth in claim 21, comprising a correction information storage circuit for storing adjustment amounts of the reference voltages, wherein

the reference voltage generating circuit adjusts the reference voltages in accordance with the adjustment amounts stored in the correction information storage circuit.

24. (Original) The liquid crystal display device as set forth in claim 22, wherein the reference voltage generating circuit adjusts the reference voltages so that a gamma characteristic is obtained in a line, constituted of the pixels, which is positioned on the one side in a direction in which the scanning lines are disposed and another gamma

characteristic is obtained in a line, constituted of the pixels, which is positioned on the other side in the direction in which the scanning lines are disposed, said gamma characteristics being different from each other.

25. (Original) The liquid crystal display device as set forth in claim 22, wherein the reference voltage generating circuit adjusts the reference voltages so as to obtain gamma characteristics different from each other in a first line constituted of the pixels provided on the one side in a direction in which the scanning lines are disposed, a second line constituted of the pixels provided on the other side in the direction in which the scanning lines are disposed, and a third line constituted of the pixels provided between the first line and the second line so that the gamma characteristic obtained in the third line is intermediate between the gamma characteristic obtained in the first line and the gamma characteristic obtained in the second line.

26. (Original) The liquid crystal display device as set forth in claim 21, wherein:
the reference voltage generating circuit adjusts the reference voltages so as to obtain a gamma characteristic which causes luminance to decrease in a numerical order of the scanning lines in a case of using a liquid crystal panel whose luminance increases while a view point is moving from an upper direction to a lower direction with respect to the liquid crystal panel when an observer faces the liquid crystal panel, and

the reference voltage generating circuit adjusts the reference voltages so as to obtain a gamma characteristic which causes the luminance to increase in a numerical order of the scanning lines in a case of a liquid crystal panel whose luminance decreases while the view point is moving from the upper direction to the lower

direction with respect to the liquid crystal panel when the observer faces the liquid crystal panel.

27. (Previously Presented) The liquid crystal display device as set forth in claim 1, wherein:

the common electrode voltage supplying circuit adjusts the common electrode voltages so that the luminance decreases in the numerical order of the scanning lines in the case of using the liquid crystal panel whose luminance increases while the view point is moving from the upper direction to the lower direction with respect to the liquid crystal panel when the observer faces the liquid crystal panel, and

the common electrode voltage supplying circuit adjusts the common electrode voltages so that the luminance increases in the numerical order of the scanning lines in the case of using the liquid crystal panel whose luminance decreases while the view point is moving from the upper direction to the lower direction with respect to the liquid crystal panel when the observer faces the liquid crystal panel.

28. (Currently Amended) A method for driving a liquid crystal display device which includes:

a plurality of scanning lines; a plurality of signal lines provided so as to cross the scanning lines;

pixel capacitors, having pixel electrodes and common electrodes, and corresponding to a liquid crystal layer, which are respectively formed on the pixels corresponding to intersections of the scanning lines and the signal lines, wherein the liquid crystal layer has liquid crystal molecules, each of which has a substantially fixed twist angle in a direction perpendicular to substrates for sandwiching the liquid crystal layer, the liquid crystal layer having a characteristic that a viewing-angle-

derived difference of luminance of pixels occurs between target pixels, which are at different positions and receive a same driving voltage, by a difference of their viewing angles on viewing from one viewing point~~depending on an observation direction, compared with right opposite viewing~~, due to asymmetry of alignment direction of the liquid crystal molecules,

said method comprising the step of supplying common electrode voltages and adjusting the common electrode voltages and changing magnitudes of the common electrode voltages depending on a position of the pixels in the liquid crystal panel so that such driving voltages as to decrease the viewing-angle-derived difference of luminance of pixels are generated.

29. (Previously Presented) The method as set forth in claim 28, wherein the common electrodes of the pixels are divided into a plurality of groups, and the common electrode voltages are respectively adjusted so as to be adjusted independently for each group.

30. (Original) The method as set forth in claim 28, comprising the step of generating reference voltages, having plural levels, which cause gradation display to be made in accordance with a display signal, and adjusting the reference voltages.

31. (Original) The method as set forth in claim 30, wherein the reference voltages are adjusted so that a predetermined gamma characteristic is obtained in an arbitrary line of lines each of which is constituted of the pixels provided in a direction in which the scanning lines are disposed.

32. (Original) The method as set forth in claim 29, wherein the common electrode voltages are adjusted so that luminance and color variation of the pixels are corrected so that a visual angle with respect to a liquid crystal panel, viewed from an arbitrary position, is wider than a visual angle in a case where the common electrode voltages of all the groups are equal to each other.

33. (Original) The method as set forth in claim 32, wherein the common electrode voltages are adjusted so that luminance and color variation of the pixels are corrected so that a visual angle with respect to a liquid crystal panel, viewed from an arbitrary position in an up-and-down direction, is wider than a visual angle in a case where the common electrode voltages of all the groups are equal to each other.

34. (Original) The method as set forth in claim 33, wherein the common electrodes in each of the pixels are sequentially grouped for n lines of the scanning lines (n includes one), where n is a positive integer.

35. (Previously Presented) The liquid crystal display device as set forth in claim 2, wherein the common electrode voltage supplying circuit adjusts the common electrode voltages to correct luminance and color variation of the pixels such that a visual angle with respect to the liquid crystal panel, viewed at least from an arbitrary position in front of the liquid crystal display device in a direction perpendicular to an extending direction of the scanning lines, is wider than a visual angle if the common electrode voltages of all the groups are equal to each other.

36. (Previously Presented) The method as set forth in claim 29, wherein the adjusting the common electrode voltages adjusts the common electrode voltages to

correct luminance and color variation of the pixels such that a visual angle with respect to the liquid crystal panel, viewed at least from an arbitrary position in front of the liquid crystal display device in a direction perpendicular to an extending direction of the scanning lines, is wider than a visual angle if the common electrode voltages of all the groups are equal to each other.

* * * * *

END OF CLAIM LISTING